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INJURY OF THE SPINAL CORD DUE TO RUPTURE OF AN INTERVERTEBRAL DISC DURING MUSCULAR EFFORT.¹

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THE following case is of interest, because it seems to throw light upon certain cases of spinal myelitis and hæmorrhage into the spinal cord arising out of strains and racks of the back in men engaged upon heavy work. So far as we are aware, the lesion is one which has not hitherto been observed, as we have been unable, after considerable search in literature and enquiry among pathologists and surgeons, to find any record of an exactly similar case.

Summary.—A man was lifting a heavy plate from the floor to a bench, when he felt a "crack" in the small of his back. He suffered intense pain, and was unable to straighten himself. Paraplegia soon developed, and patient died sixteen days later, principally from the effects of bedsores and septic cystitis. The cause of the paraplegia was hæmorrhage and softening in the lumbar enlargement of the spinal cord, and the cause of this was found in a mass of the pulp of an intervertebral disc which had been displaced into the vertebral canal.

History of the case.—W. M., age 38 years, engineer's labourer, was admitted to Glasgow Royal Infirmary on 12th February, 1910, under the care of Dr. Paterson, and transferred to Dr. Middleton's ward on 16th February. The history of the case was as follows:—

¹ Read at a meeting of the Medico-Chirurgical Society of Glasgow held on 3rd March, 1911.

At 6:30 A.M. on 8th February, while patient and another man were lifting a heavy plate from the floor to a bench, he "felt something crack in his back." He could not stand up straight, but had to go bent on account of pain and a feeling of weakness in his back. He remained for about a quarter of an hour at the works trying to "straighten himself," and then walked home—two or three minutes' walk—without assistance, unable to straighten his back, but not conscious of any loss of power in his legs. The metal plate was to be placed on a bench, about 3 feet in height, so that he had not to raise his arms to any height. He was assisted by another man, who apparently has not suffered in any way, and M. himself said he had lifted heavier weights many a time without injury.

When he reached home he sat in a chair, fairly comfortable, except when he moved; movement causing intense pain from the back round both sides, evidently not of a girdle character. He was seen about 1 o'clock by his doctor, who ordered him to bed. He was able, with assistance, to walk over to his bed, but it is probable that he had even then lost some power in his legs, as he said he could not stand, and his legs gave way under him; he himself attributed the difficulty to the "excruciating pain in the back."

In bed he lay most uncomfortably, turning and twisting in his efforts to find a comfortable position, and suffering much pain in his vain endeavours to do so. He evidently had no great difficulty in turning in bed or moving his legs. He was sick, but did not vomit. He took some supper on the night of the 8th, but no solid food thereafter. That night he passed water normally for the last time. Between 2 and 3 o'clock in the morning of the 9th he felt a sudden agonising pain shoot down "from his chest to his feet," with peculiar sensations as if the limbs were "sleeping." This feeling passed away in a short time, and he then found he could not move either limb. Prior to this he was not aware of any paralysis. His arms were not at all affected. He thought the condition grew worse instead of better as the night wore on, but from his statement there must have been almost complete paralysis immediately after the sudden pain. His bladder and bowels now became paralysed, and after two days his doctor was again called in. Two days later he was sent up to the surgical wards as a case of intestinal obstruction. His bowels moved in the ambulance van without his knowledge.

Condition on admission.—There was great distension of

intestines and bladder. The urine was ammoniacal, with some pus in it. Both legs were absolutely paralysed, and were flaccid. The knee-jerks, and all reflexes of the lower limbs and the cremasteric reflexes, were absent. There was also complete anæsthesia and analgesia of the lower limbs as high as Poupert's ligament.

Patient was rather flushed in the face, and seemed to be in pain. Both his legs were atrophied in their whole length, the gluteal muscles sharing in the atrophy. Both sides were affected equally. Rigidity was beginning to set in.

On his back, at the upper part of his buttocks, there were two bedsores, or rather "acute decubital" sores—that on the left side was the more advanced, and its centre was black and sloughing. The heart and lungs appeared to be normal. Temperature, 98·8°; pulse, 80; respiration, 24. He had always been healthy; not a drinker; a light smoker; and there was no history of syphilis.

Patient grew steadily weaker, the signs of septic infection of the urinary tract more pronounced, the temperature rose, and rigors occurred. He died on 24th February, sixteen days after the accident.

Post-mortem examination (20th February, 1910, No. 6,253).—*External appearances:* A small, strongly-built man, somewhat emaciated. No external sign of injury. Bedsores in the sacral region. No irregularity of the vertebral column could be made out either externally or internally after opening the canal. It was noted that the backs of the vertebral bodies seen through the vertebral canal appeared rather more porous than usual. There was no blood clot outside the dura mater.

Spinal cord: The spinal cord was removed, and the dura mater opened very carefully from behind. There was marked softening of the lumbar enlargement, with brown staining, indicative of some hæmorrhage into the cord, but there were no blood clots. From about the upper end of the lumbar enlargement the cord appeared to be normal. After a cursory inspection it was placed in a 5 per cent formalin solution to harden.

The brain appeared perfectly healthy.

The internal organs showed early hypostatic pneumonia at the base of the left lung, and septic cystitis, pyelitis, and abscesses in the kidneys.

Further examination of the spinal cord after hardening.—The cord contained no distinct large hæmorrhage, but there

was much blood in streaks through several segments of the lumbar enlargement. There was also a segment of cord, about a quarter of an inch in length, well down in the lumbar enlargement, which was thinner than the rest, and appeared to have been crushed. Opposite this, entangled in the loose fibrous tissue, on the exterior of the dura mater, there was an irregular, roughly circular flat mass of firm white tissue, which looked rather like the pulp in the centre of the intervertebral discs. Microscopic sections showed the structure characteristic of the pulp of the intervertebral discs. The mass measured about 15 mm. in diameter by 5 mm. in thickness. Its margins were ragged, with a few red blood corpuscles clinging to them and entangled in the shreds. There was no sign of inflammatory reaction about it. It lay on the front of the theca of the cord, somewhat to the right of the middle line, and extended as far back as the line of exit of the nerve roots.

Microscopically, the spinal cord showed advanced softening, with degeneration amounting almost to necrosis in the central parts, and much diffuse blood infiltration. This condition extended some distance above and below the crushed segment. There was early secondary degeneration of the various tracts of the cord. The softened parts were full of compound granular corpuscles. A thrombosed vessel was found in the section of the cord which showed most hæmorrhage.

The nature of the injury was quite clear. The cord had been compressed, and softening (myelitis) of considerably wider extent than the area actually injured had followed. Probably the injury to the cord was increased by the movements of the patient during the twenty hours following the accident, and the sharp pain which then occurred and the paralysis which ensued were due to the occurrence of hæmorrhage into the cord.

The body which caused the injury, and its nature and source, are also clear. The position which it occupied is that to which it would be directed by the powerful ligament which lies on the posterior surface of the vertebral bodies in the middle line. Unfortunately the portion of intervertebral disc was not noticed until the day after the examination, and it was impossible to obtain another examination of the body; but injury or displacement of the vertebræ of the common types had been searched for, and can be excluded.

From the position of the injury to the cord it is probable that the disc which gave way was that between the twelfth dorsal and the first lumbar vertebræ.

With regard to the mechanism of the injury, it can be inferred from the history of the case that the man, at the moment at which he felt the "crack" in his back, must have had his back more or less bent forward, with the lumbar and abdominal muscles in full action. This would cause powerful compression of the intervertebral discs, with the anterior margins of the vertebræ approximated to one another, and, therefore, in a favourable position for displacement of the pulp of the intervertebral disc backwards, if that were possible.

To test this theory of the injury experiments were made to see whether the pulp of the intervertebral disc could be squeezed out through the strong surrounding ligaments, and the direction which it would take.

In one a successful result was obtained. The first three lumbar vertebræ from the body of a well developed man with no disease of the column were placed in a carpenter's wooden vice, and pressure made rather more to the front than to the back. The cord and nerves had been cut out, leaving the *dura in situ*. It was noted before pressure that the position of the intervertebral discs was shown by slight bulging inwards. After pressure had been applied a definite rounded prominence could be seen opposite the disc between the first and second lumbar vertebræ, close to the side of the posterior longitudinal ligament.

The pressure had not been very powerful—certainly not enough to crush the bones at all. Repeating the experiment with more powerful pressure the swelling was seen to increase slightly.

The arches were then cut out and the *dura mater* raised. The rounded swelling was found with the fibrous outer layer of the disc intact. Pressure with an iron vice to crushing of the bone failed to produce any further swelling.

On cutting through the disc with a sharp knife it was found that the swelling actually was due to displacement of the soft pulp, which had forced its way through the inner fibrous layers of the disc as far as the outer sheath. The corresponding area on the other side was unchanged. The pulp of the disc had, therefore, been displaced, and it had travelled in the direction which it must have followed in the victim of the accident.

A case which presents a similarity to the present one in respect to the injury of the intervertebral disc without injury of the vertebral bodies has been recorded by Kocher. The cause of the condition was, however, entirely different.

*Case of Joh. Messerli.*¹—A man, æt. 26, fell 100 feet upon a stone pavement on his feet and walked 20 to 30 steps thereafter. He complained of burning sensation in the scrotum and penis and lower part of abdomen, and girdle pain in the horizontal navel line, and pain on sitting up in the region of the first lumbar vertebra. The spine of the first lumbar vertebra projected strongly and was painful to pressure. He had some difficulty in moving his lower limbs. Sensation was normal. There were many other injuries, including rupture of the bowel, from which he died in some hours. *Post-mortem* examination showed fracture of the sternum and ulna, laceration of the jejunum, and peritonitis. There was complete smashing of the intervertebral disc between first and second lumbar vertebræ, and it had been squeezed out from between the vertebral bodies. The bodies themselves and the spinal cord appeared to be undamaged. There was a definite curvature at the level of the crushed disc. There is no information as to the direction in which the crushed out portions of the disc had travelled.

While this case is different in many respects from that now recorded, it shows that the intervertebral disc may be injured without visible injury of the vertebræ themselves, and this is confirmed by experiment. The rupture of an intervertebral disc during muscular effort may prove to be a very rare injury, but it may prove to be the explanation of certain cases the nature of which has been regarded as quite obscure, or which have been ascribed to the rupture of a vessel in the cord during exertion.

¹ *Mittheilungen aus den Grenzgebieten der Medizin und Chirurgie*, Jena, 1896, vol. i, p. 420.



